

In a country with little water, and so great a disparity between the levels, and where coals could not be obtained to work steam-engines, such a plan was certainly a good medium between navigation and cartage; but as the whole trade was to go up the country, I was astonished to find, by calculation, that the horses to perform the estimated four hundred tons per day, would amount to 7,000l. per annum on the rail-roads only.

Seeing these difficulties, and the necessity of an easy communication with hilly countries, I was impressed with the importance of an apparatus, which might transfer boats and their cargoes, to and from the different levels; independent of locks and their demand of water, or rail-roads and their appendage of horses.

To produce such a machine, the first thing that occurred to my imagination, was a water-wheel, to be put in motion by water from the upper level; and, by that means, raise the boat on an inclined plane. But in great ascents, I found the wheel destroy more water than locks; I then thought of a preponderating cistern of water, and was so certain of obtaining the power by that means, that I immediately conceived I had accomplished the machine; and having some communication with his Lordship, *on the practicability of navigating vessels by steam*, I sent him a sketch of my plan: his Lordship, in answer, was pleased to compliment me on the thought; but at the same time informed me, it was the same as described by Mr. Edmund Leech, about sixteen years since. Here, for the first time, I discovered that the idea of a preponderating body of water,

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was by no means new. But, on investigating Mr. Leech's work, I found, that although our ideas of the cistern were nearly similar, yet we were far distant from the point to be attained; each using it on an inclined plane, without any certain mode of getting the boat in and out of the upper canal. I then changed the cistern from the inclined plane, to a perpendicular descent; because, in a perpendicular, the descending body acts with a force equal to its whole weight, *friction excepted*; while, on the plane, its descending force is lost in proportion to the angle; after which, my whole difficulty has been to get the boats in and out of the upper canal, with certainty, ease, and expedition, so as to preserve a regular movement, and avoid much wear on the works.

To effect this, I have tried various experiments, and ultimately determined on the *four* modes described by the annexed Plates, each of which works with great certainty and ease, *varying from double to single machines*; and have at least established the practicability of passing boats to and from the different ponds of canals, independent of locks, rail-roads, or steam-engines.

Having accomplished a mode of passing the disparity of the levels, the next important consideration in reducing the expence of canals, was to cross rivers, or deep and wide valleys, without aqueducts. The following Plates will also exhibit the cheap mode by which this part of the work may be performed; and the reader will judge of the facility with which it may be executed.

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